ARGUMENTS/REMARKS

Claims 2, 3, 5-14 and 18-26 are pending in this application.

Claims 11-14 have been withdrawn.

Claims 2, 3, 5-14 and 18-26 stand rejected. No claims stand allowed.

Claim 25 has been amended to correct minor informalities in accordance with the Examiner's suggestion.

No new matter has been introduced by this amendment.

Claim Objections

Claim 25 stands objected to because of minor informalities. Claim 25 has been amended to correct the spelling of the word "greater" in accordance with the Examiner's suggestion.

With this amendment, it is respectfully requested that the objections be withdrawn.

Claim Rejections – 35 USC §103

Claims 2, 3, 5-10, and 18-26 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Imafuku (U.S. Patent No. 6,074,518) in view of Lenz (U.S. Patent No. 6,019,060), among which claim 2 is the independent claim.

In the Final Office Action, the Examiner maintains all of the rejections set forth in the previous action, specifically alleging that it would have been obvious to modify the apparatus taught by Imafuku to incorporate the vertically arranged and movable confinement rings taught by Lenz in order "to allow local control of the pressure at the substrate surface during plasma processing, and thereby, among other benefits, to improve response time." Applicants respectfully disagree for the reasons set forth below.

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: ... (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and ... *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986), also see M.P.E.P. §2141, II.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)

Claim 2

Claim 2 recites, among others, that a magnetic field magnetically enhancing physical confinement provided by the at least one confinement ring, wherein magnetic field lines passing from the first magnetic element to the second magnetic element pass through the at least one confinement ring.

Attached is a declaration by Doug Keil that provides technical support as to why it would not be obvious to combine Imafuku and Lenz to obtain the invention as recited in claim 2. The declaration states that one reason why it would not be obvious to place the confinement rings of Lenz into Imafuku is that such rings would be redundant (paragraph 11). In addition, the placement of the rings of Lenz into a device of Imafuku would not be placed as recited in claim 2, because such rings placed as recited in claim 2 would interfere with the purpose and teaching of the magnetic fields in Imafuku (paragraph 12). In addition, the use of the magnets of Imafuku with the confinement rings of Lenz would be contrary to the invention as recited in claim 2, because such magnets by themselves would confine charged particles, instead of working with the confinement rings to provide enhanced physical confinement (paragraphs 13-15).

Imafuku relates to plasma confinement in a plasma processing apparatus. In FIG. 12 thereof, Imafuku shows magnets (or magnet assemblies) 72 and 74 to form an annular local magnetic field between the circumferential edge portion of the upper electrode 21 and circumferential portion of the susceptor 5 (column 12, lines 40-44 thereof). The purpose of Imafuku's magnets is to confine the plasma, and the magnetic field encircles the plasma

generating region, thereby enclosing the plasma in the plasma generating region" (column 12, lines 43-47 and column 20, lines 22-24 of Imafuku).

However, the magnets 72 and 74 are not the only means for plasma confinement Imafuku teaches. Imafuku also describes other plasma confining "arrangement wherein at least one electrode is provided in addition to the upper electrode 21 and the susceptor 5" (column 12, lines 10-12 thereof), which is a ground electrode 27 (column 9, lines 36-59, FIGS. 2-4 thereof), or a pair of ground electrodes 27 and 66 having a ring-like shape (column 9, line 60 – column 10, line 24, FIGS. 5-6 thereof). As Imafuku's ground electrodes 27 and 66 prevent the plasma from diffusing to the inner wall of the chamber (column 2, lines 16-22, column 35-43), Imafuku's ground electrodes 27 and 66 are plasma confinement rings similar to those of Lenz's, except Imafuku's are not cam-based.

Furthermore, Imafuku also mentions discharge of a process gas introduced to the plasma generation region through the confinement ring(s). In Imafuku, while the plasma is confined by the ground electrode 27 (and the upper electrode and the susceptor), the process gas is discharged from the gap between the ground electrode 27 and the focus ring 15 at a constant flow speed (column 8, lines 36-48 of Imafuku). When the ground electrode 27 has a cylindrical shape largely extending downward, Imafuku provides the ground electrode 27 with a plurality of through holes 64 in order to fully assure discharge of a process gas introduced to the plasma generation region (column 9, lines 50-57). When the ground electrode 27 has a tapered surface, the focus ring 15 also has a tapered surface in order to define a discharge pass of a process gas to realize the smooth flow of the discharge gas toward discharge pipes (column 10, lines 34-46 of Imafuku). Thus, Imafuku is fully aware of necessity of proper discharge of the process gas from the plasma generation region when the plasma is physically confined by the ground electrode or confinement ring(s). Although Imafuku does not use the word "pressure," it is apparent for those of ordinary skill in the art that the pressure in the plasma generation region would increase if the process gas is not properly discharged from the gap between the ground electrode 27 and the focus ring 15 or the gap between the ground electrodes 27 and 66 (see FIG. 6 of Imafuku, for example). It should be noted that when magnetic fields are used to confine plasma, there is no need to provide a discharge path for a process gas because uncharged gas molecules are freely travel through the magnetic fields, and thus Imafuku does not mention any discharge path in its magnet embodiment of the plasma confinement.

Accordingly, when Imafuku is considered as a whole, Imafuku teaches two types of plasma confinement means: one using the confinement rings; and the other using the magnets or magnet assemblies. Imafuku clearly states that "a large number of opposing magnets" are provided in place of the confinement rings (column 12, lines 12-14). That is, Imafuku teaches the magnets 72 and 74 as an alternative of the confinement rings. Teaching of two alternatives of the same purpose and function teaches away from combining the two alternatives, because such a combination is unnecessary and redundant, and also unnecessarily increases the cost and complexity of the apparatus. When each of two different measures achieves the full desired function (i.e., confinement of plasma), those of ordinary skill in the art would not combine or implement both of the two different measures in the same apparatus. As stated above, paragraph 11 of the attached declaration states that one of ordinary skill would view the combination of the magnets of Imafuku with the physical confinement rings of Lenz as redundant. Accordingly, Imafuku teaches away from combining Imafuku's magnets, which the Examiner alleges "structurally identical" to the claimed magnetic elements, with any confinement rings and it would not be obvious to combine the magnets of Imafuku with the confinement rings of Lenz.

The Examiner argued that it would be obvious to combine Lenz's cam-based confinement ring so as "to allow local control of the pressure at the substrate surface during plasma processing, and thereby, among other benefits, to improve response time," with Imafuku's magnets. However, since Lenz teaches that the position of the confinement rings relative to one another can be changed so as to facilitate local control of the pressure (column 7, lines 64-67 thereof), those of ordinary skill in the art who fully understand Imafuku's teaching would naturally modify Imafuku's confinement ring, not the Imafuku's magnets, as argued by the Examiner.

In addition, that fact that Imafuku, which teaches both the magnets and confinement rings, fails to combine such magnets and confinement rings strongly indicates the failure of others who has known both of the structures (magnets and confinement rings) to make the claimed combination of the magnets with the confinement rings.

Furthermore, Imafuku's magnets are by themselves sufficient or strong enough to confine the plasma. Thus, even if Lenz's confinement ring should be added to Imafuku's plasma processing apparatus, Imafuku's magnets alone would generate a magnetic field to confine the plasma, and thus would not be able to generate a magnetic field for magnetically enhancing

physical confinement provided by the at least one confinement ring, as recited in claim 2. By magnetically turning the charged particles back into the chamber the magnets of Imafuku would actually reduce collisions with the rings, since less particles would reach the rings, and therefore physical confinement would be reduced not enhanced. The claimed cooperative or interactive arrangement of the magnetic field and confinement ring(s) is novel and not obvious. The claimed magnetic field bends trajectories of charged particles and/or increases the path length of charged particles as described in page 6 of the present specification, because the magnets are not strong enough to completely turn the charged particles, but only bend the trajectories. In accordance with the claimed magnetic field, the charged particles are directed into the confinement rings and/or cause to collide into the confinement ring(s), as specifically recited in dependent claim 3, contrary to Imafuku's magnetic fields which necessarily turn the charged particles away form the chamber walls towards the plasma generating region for magnetic confinement. Without Applicant's teaching, the alleged combination of Imafuku and Lenz would not yield the claimed specific arrangement the magnetic field and the confinement ring(s), and thus would not enhance physical confinement. The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention. Such an idea of magnetic enhancement of the physical confinement is neither suggested by nor necessary present in any of the cited references.

In addition, if Lenz's cam-based confinement ring should be provided to Imafuku's chamber with the magnets in order only "to allow local control of the pressure," the Lenz's confinement ring must be used as a pressure controller, not something to confine the plasma, since the plasma is already magnetically confined in Imafuku's apparatus. That is, Lenz' confinement ring (pressure controller) should be provided so as not to interfere with Imafuku's magnetic fields. If Lenz's confinement rings interfere with Imafuku's magnetic fields, such interference would also disturb the plasma confinement in Imafuku's apparatus, which is undesirable, as discussed in paragraphs 12—14 of the declaration. If Lenz's confinement rings are disposed inner side of Imafuku's magnet arrangement, they may intercept trajectories of the charged particles of the plasma before Imafuku's magnetic field confines the plasma, or worse may adversary affect the plasma process such as etching or spattering. Thus, those of ordinary skill in the art would have to place Lenz's confinement ring so as to surround the magnetically confined plasma to provide the additional local control of the pressure. In any case, in order for the allegedly modified apparatus of Imafuku to properly operate and confine the plasma with the alleged benefit of local pressure control, the Lenz's confinement ring must operate as a pressure

controller without plasma confinement function, and the magnets must independently provide plasma confinement without interference of the Lenz' confinement ring with the magnetic field, contrary to the claimed invention in which the confinement ring and the magnetic field are cooperatively interacts such that the magnetic field enhances the physical confinement by the confinement ring and so that magnetic field lines pass through the confinement ring.

Accordingly, first the cited references teach away from the alleged combination, and second, even if the teachings of the references should be combined according to the alleged motivation and benefit, the alleged combination would not yield the claimed invention. Accordingly, the claimed invention would not be obvious from the alleged combination of Imafuku and Lenz. Therefore, it is respectfully requested that the rejection based on Imafuku and Lenz be withdrawn.

Regarding Dependent Claims:

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Claims 3, 5-10 and 18-26 directly or indirectly depend from claim 2 and thus include all of the limitations of claim 2. Accordingly, these dependent claims are also patentable at least for the same reasons discussed above.

Nevertheless, Applicants respectfully assert that the dependent claims further recite additional patentable features as set forth below.

With respect to claim 5, Examiner alleges that, although the alleged combination does not teach a specific dimensional relationship between the magnetic elements and the confinement rings, "the inner and outer diameter of the confinement rings is not believed to cause difference in performance of the apparatus, since narrower or wider confinement rings would still be just as capable of closing and opening the variable gap." However, as discussed above, the claimed invention is not obtained by the alleged combination of Imafuku and Lenz, but requires a specific interactive arrangement of the magnets and the confinement rings which is missing from the alleged combination. While in the alleged Imafuku-Lenz combination the magnetic fields

confine the plasma and the confinement rings control the local pressure as the Examiner alleges, in the claimed invention, the confinement ring(s) and the magnetic field passing therethrough cooperatively provide effective confinement of plasma by increasing collision of charged particles onto the confinement ring(s). Claim 5 recites specific configuration achieving such a cooperative arrangement, namely, the first and second magnetic elements are located between the inner and outer diameters of the confinement ring(s), as shown in FIG. 2 of the present application. As discussed above, if the rings of Lenz were placed in a device described in Imafuku, the magnets of Imafuku would be placed within the inner diameter of the rings of Lenz to prevent the rings from interfering with the magnetic confinement of Imafuku. Such a configuration would not meet the limitations of claim 5.

Claims 6, 19, 22, and 24-26 recite another specific configuration achieving such a cooperative arrangement: the magnetic field lines' intersecting the confinement ring(s) at an angle between being perpendicular to 45°, or in a canted manner, which is illustrated in, for example, FIGS. 6 and 7 of the present application. It should be noted that if a particular magnetic field is produced in order to optimize the confinement of the charged particles, as the Examiner alleges, such a strong magnetic field would not be suitable for magnetically enhancing physical confinement. The Examiner stated that Imafuku does not disclose such magnetic fields but that it would be obvious to one of ordinary skill, as a matter of routine experimentation, to obtain the claimed diameters to provide the canted magnetic fields. Because Imafuku relies on magnetic confinement, experimentation to provide the strongest magnetic field would not provide the canted magnetic fields as claimed, since such fields would reduce magnetic confinement. Since the invention uses the magnetic fields to increase physical confinement, the canted fields are important, since they increase physical confinement when used in conjunction with confinement rings and when the magnetic fields are not strong enough to confine charged particles, but only bend the trajectory a small amount.

Accordingly, those dependent claims, among others, further provide patentable features of the present invention. For at least these reasons, claims 3, 5-10 and 18-26 are not anticipated or made obvious by the cited references.

Conclusion:

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner.

Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
BEYER WEAVER LLP

/Michael Lee/
Michael Lee
Reg. No. 31,846

P.O. Box 70250
Oakland, CA 94612-0250
(408) 255-8001